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L16: Entry 21 of 41 File: USPT Sep 24, 2002

US-PAT-NO: 6455083
DOCUMENT-IDENTIFIER: US 6455083 B1

TITLE: Edible thermoplastic and nutritious pet chew

DATE-ISSUED: September 24, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
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APPL-NO: 09/ 467412 [PALM]
DATE FILED: December 20, 1999

PARENT-CASE:
This application is a continuation-in-part of application Ser. No. 09/145,659, filed Sep. 2, 1998, now U.S. Pat. No. 6,379,725, which is a continuation in part of Ser. No. 09/072,857 filed on May 5, 1998, U.S. Pat. No. 5,922,379, issued on Jul. 13, 1999.

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PRIOR-ART-DISCLOSED:

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Search Selected | Search ALL

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ART-UNIT: 1761

PRIMARY-EXAMINER: Corbin; Arthur L.

ATTY-AGENT-FIRM: Madson & Metcalf

ABSTRACT:

The present invention relates to an edible thermoplastic made from about 30 to 50 wt. % protein comprising a mixture of plant and animal derived protein, about 20 to 50 wt. % starch about 10 to 20 wt. % water, about 1 to 10 wt. % edible fiber, and about 0.5 to 3 wt. % metallic salt hydrate. When molded, the thermoplastic has good strength and stiffness and other physical properties. The edible thermoplastic may be molded in a variety of shapes including a segmented nutritional pet chew with a plurality of segments separated by a plurality of scores. The scores serve to structurally weaken the pet chew so that it may be broken into smaller pieces. When molded the edible thermoplastic has a density of about 1.2 to 1.5 g/cubic centimeters.

36 Claims, 3 Drawing figures

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DOCUMENT-IDENTIFIER: US 6455083 B1
TITLE: Edible thermoplastic and nutritious pet chew

Abstract Text (1):
The present invention relates to an edible thermoplastic made from about 30 to 50 wt. % protein comprising a mixture of plant and animal derived protein, about 20 to 50 wt. % starch about 10 to 20 wt. % water, about 1 to 10 wt. % edible fiber, and about 0.5 to 3 wt. % metallic salt hydrate. When molded, the thermoplastic has good strength and stiffness and other physical properties. The edible thermoplastic may be molded in a variety of shapes including a segmented nutritional pet chew with a plurality of segments separated by a plurality of scores. The scores serve to structurally weaken the pet chew so that it may be broken into smaller pieces. When molded the edible thermoplastic has a density of about 1.2 to 1.5 g/cubic centimeters.

Brief Summary Text (2):
The invention relates to edible thermoplastics. More particularly to a pet chew made from an edible, protein-based nutritious thermoplastic and methods of use thereof.

Brief Summary Text (14):
Recently pet chews have been developed that serve different needs. For example environmentally friendly chews have been made of natural corn, wheat, or rice starch with a biodegradable co-polymer. Other chews contain cellulose fiber which is also biodegradable. In order to lessen the risk of injury to a pet, chews have been developed that are resistant to splintering.

Brief Summary Text (17):
The present invention is directed to an edible thermoplastic for use in animal chews and pet foods. The thermoplastic is made from a combination of plant and animal derived proteins. Other ingredients are added to ensure that the animal is provided a full compliment of calories and nutrition. To this end, the edible thermoplastic contains starch, fiber, and a metallic salt hydrate. In one preferred embodiment of the invention, the thermoplastic is made from about 30 to 50 wt. % of a mixture of plant protein and animal protein, about 20 to 50 wt. % starch, about 10 to 20 wt. % water, about 1 to 10 wt. % edible fiber, and about 0.5 to 3 wt. % metallic salt hydrate. When the thermoplastic is molded it preferably has a density of about 1.2 to 1.5 g/cubic centimeters.

Brief Summary Text (18):
A currently preferred plant protein is soybean protein. The soybean protein may be obtained from a variety of sources including soy protein concentrate, soy protein isolate, and a combination thereof.

Brief Summary Text (19):
The plant protein may also contain proteins from other plants including grains. Such grains may include, but are not limited to, wheat, rye, oats, barley, corn, rice, millet, and sorghum. The grain proteins are preferably selected from gliadin, gluten, secalin, avenin, hordein, zien, oryzenin, kafirin, and a combination thereof It should be appreciated that a combination of soy, grain, and other plant proteins is within the scope of the present invention.

Brief Summary Text (20):
The animal protein may also come from a variety of sources including, but not limited to, casein, albumin, collagen, gelatin, keratin, and combinations of these and other animal derived proteins.

Brief Summary Text (23):
The edible fiber of the present invention may include soluble and insoluble fibers. These fibers may include dietary fiber, natural cellulose fiber, and combinations of these and other fibers.

Brief Summary Text (37):
The invention also relates to an nutritious pet chew molded into a segmented configuration such that individual segments can be broken off and given to the pet as desired. A pet chew may be formed having a plurality of segments separated by a plurality of notches, groves, perforations, or incisions or other localized structural weakenings, hereinafter referred to as scores. The scores serve to weaken the pet chew at predetermined locations. The weakened pet chew can be broken at the score location to remove a segment to give to the pet. The pet chew may be formed in a variety of cross sectional configurations. Such cross sections may include, but are not limited to, a circle, a square, a rectangle, a polygon, an oval, a star, or a fantasy shape such as the outline of a state, a dog breed, or other symbol.

Brief Summary Text (39):
The pet chew may be formed to be substantially linear or may be curved, circular, or take on any shape.

Detailed Description Text (2):
The present invention is directed to an edible thermoplastic for use in pet chews. The edible thermoplastic is formulated to provide balanced nutrition to the pet while caring for the pets oral hygiene. The edible thermoplastic is preferably made by combining plant and animal protein, starch, carbohydrates, various nutrients, dietary fibers, hygiene additives, preservatives, water, processing aids, flavorings, coloring agents, and modifiers.

Detailed Description Text (4):
In one currently preferred embodiment of the present invention the edible thermoplastic contains about 30 to 50 wt. % of a combination of plant and animal protein and 20 to 50 wt. % starch.

Detailed Description Text (7):
The protein is preferably be a combination of plant and animal protein. Plant protein and animal protein contain different amino acids, minerals, trace elements, vitamins, and other nutrients. Thus, the combination of plant and animal proteins in the edible thermoplastic provides a nutritional balance of amino acids, minerals, trace elements, vitamins, and other nutrients.

Detailed Description Text (8):
As previously mentioned the edible thermoplastic may be formulated with a plant protein. Such plant proteins include soybean protein. Soybean protein may be used alone in one embodiment of the invention or in combination with other plant or animal proteins. Soybean protein may be used in various forms such as soy protein isolate, soy protein concentrate, and a combination thereof Plant proteins from other sources such as grains may also be used in some embodiments of the edible thermoplastic. Such grains may include wheat, rye, oats, barley, corn, rice, millet, and sorghum. Thus, the plant proteins may include gluten, zein, hordein, avenin, kafirin, secalinin, panicin, and oryzenin in certain embodiments of the present invention.

Detailed Description Text (9):
Animal proteins may be used alone or in combination with the plant proteins. Examples of suitable animal proteins include casein, albumin, collagen, gelatin, and keratin. Microorganisms such as baker's yeast or beer yeast may also provide a source of protein in one embodiment of the invention.

Detailed Description Text (10):
In addition to the naturally occurring proteins listed above, chemically modified proteins can be used to improve the processing flowability and physical properties of compositions.

Detailed Description Text (15):
Fiber is also an important aspect of the current invention. Natural crude fibers used in the edible thermoplastic may include soluble and insoluble dietary fibers. Insoluble fibers may come from wheat bran. Sources of soluble fibers include vegetable fiber, fruit fiber, and some grain fiber such as oats and barley.

Detailed Description Text (16):
Dietary fiber is important as a fecal bulking agent. Wheat bran is an effective fecal bulking agents. The major physiological benefits of natural crude fiber include promoting regularity, preventing constipation, and protecting against colon and other cancers.

Detailed Description Text (33):
Referring now to FIGS. 1 to 3, the cross-section 20 of the nutritious pet chew 10 may be formed in a variety of forms such as square 22, rectangle 24, and circle 26. The cross-section 20 may also be formed in the shape of a star, an oval, or a fantasy shape such as a breed of dog, a trademark shape, the outline of a state, and the like.

Detailed Description Text (40):
The edible thermoplastic was made of a combination of plant protein and animal derived proteinic material composition with starch or carbohydrates. The ingredients were premixed together in a high speed mixer, Henschel Mixers America, Inc., FM10 heater mixers at room temperature, mixer speed 1800 rpm for 3 to 4 minutes. The ingredients were further processed by a Leistritz Micro-18 Co-rotating twin screw extruder with a 6 inch sheet die having six barrel zones.

Detailed Description Text (43):
The ingredients and results of this composition are shown are shown in Table 1. Table 1 also shows the physical properties the molded edible thermoplastic made from a combination of plant protein, animal protein, and starch.

Detailed Description Text (45):
The results show that the pet chew made of a combination of wheat gluten and gelatin has larger elongation percentage than both the combination of soy protein isolate and casein and a combination of soy protein concentrate, wheat gluten, and gelatin.

Detailed Description Text (47):
Sample 4 shows that the puppy teething treat made of a combination of soy protein concentrate, wheat gluten and gelatin. The thermoplastic of sample 4 has a better combination of rigidity and stiffness than sample 2 and 3 as well as higher tensile strength and better elongation percentage and Young's Modulus.

Detailed Description Text (51):
Samples 1 and 2 show that the combination of soy protein concentrate and wheat gluten with carbohydrates, and wheat flour has a higher tensile strength and Young's Modulus than the combination of soy protein concentration and wheat gluten with corn starch.

Detailed Description Text (59):
The Effect of Dietary Fibers on Physical Properties of the Edible Thermoplastic

Detailed Description Text (60):
Table 4 illustrates the effect of fiber on the physical properties of the edible thermoplastic. As shown by samples 1 and 2 the tensile strength and Young's Modulus were increased with the addition of dietary fiber, while the elongation percentage was decreased with the addition dietary fiber.

Detailed Description Text (61):
The dietary fibers not only improve physical properties of the edible thermoplastic, but also have physiological benefits of promoting regularity, preventing constipation, protecting against colon and other cancers. Fiber also helps in cleaning a pet's teeth. Accordingly, the fiber content of the edible thermoplastic preferably ranges from about 0.5 to 10 wt %.

Detailed Description Paragraph Table (1):
TABLE 1 Sample No. Ingredients.sup.1 1 2 3 4 Soy Protein.sup.2 23.6 -- 31.1 15.55 Wheat Gluten.sup.3 23.6 31.1 -- 15.55 Casein.sup.4 -- -- 8.5 -- Gelatin.sup.5 12.8 8.5 -- 8.5 Corn Starch.sup.6 -- 25.4 25.4 25.4 Garlic Powder.sup.7 1.72 1.1 1.1 1.1 Onion Powder.sup.8 1.72 1.1 1.1 1.1 Lecithin.sup.9 0.85 0.6 0.6 0.6 Turkey Powder.sup.10 4.3 2.8 2.8 2.8 Chicken Powder.sup.11 4.3 2.8 2.8 2.8 CaCO.sub.3.sup.12 0.85 0.6 0.6 0.6 Tricalcium Phosphate.sup.13 0.85 0.6 0.6 0.6 VD.sub.3.sup.14 0.04 0.03 0.03 0.03 H.sub.2 O.sup.15 8.47 8.47 8.47 8.47 Glycerol.sup.16 16.9 16.9 16.9 16.9 Mechanical Properties Specimen Moisture Content(wt. %) 14.0 11.0 13.0 10.0 Tensile Strength (MPa) 1.62 0.978 1.47 1.53 Elongation (%) 52.5 103 17.0 65.2 Young's Modulus (MPa) 203 65.1 11.6 166 Processing Properties T Die (.degree. C.) 74 68 75 80 Screw Speed (rpm) 150 150 150 150 Feeder Rate (%) 14 23 18 24 Die Pressure (psi) 560 160 230 170 .sup.1 Ingredients are based by total weight as 100 parts. .sup.2 Soy Protein: Sample No. 3 is PROFAM .RTM. 648 Isolated Soy Protein Archer Daniels Midland Company; Sample Nos. 1,4 are PROFINE .RTM. VF Soy Protein Concentrate, Central SOYA Co., Inc. .sup.3 Wheat Gluten: GEM OF THE WEST .RTM. Vital Wheat Gluten, Manildra Milling Corporation .sup.4 Casein: from bovine milk, approximately 90% protein (biuret) and 0.2% Lactose, SIGMA Chemical Co. .sup.5 Gelatin: 250 Bloom, Dynagel, Inc. .sup.6 Corn Starch: C Polar Tex 05735, Stabilized and Crosslinked corn starch E1442 (hydroxypropl distrach phosphate), CERESTAR USA, INC. .sup.7 Garlic Powder: Tone's Brothers, Inc. .sup.8 Onion Powder: Tone's Brothers, Inc. .sup.9 Lecithin: Enhance 97, Central Soya Co., Inc. .sup.10 Turkey Powder: Mondovi Foods Corporation .sup.11 Chicken Powder: Mondovi Foods Corporation .sup.12 CaCO.sub.3 LIGHT .RTM. Calcium Carbonate, Specialty Minerals, Inc. .sup.13 Tricalcium Phosphate: FMC .RTM. Food Grade, FMC Corporation Phosphorus Chemicals Div. .sup.14 Vitamin D3: Vitamins, Inc. .sup.15 Water: Distilled Water, WalMart Stores, Inc. .sup.16 Glycerol: Glycerine 99.5% USP, Ashland Chemical Company

Detailed Description Paragraph Table (2):
TABLE 2 Sample No. Ingredients.sup.1 1 2 3 4 Soy protein concentrate (VF) 15.55 15.55 14.7 15.1 Wheat gluten 15.55 15.55 14.7 15.1 Gelatin 8.5 8.5 8.0 8.24 Corn starch 25.4 -- 24.1 24.7 Wheat flour.sup.2 -- 25.4 -- -- Sodium alginate.sup.3 -- -- 5.3 -- Nutricol GP 751 F.sup.4 -- -- -- 2.75 Garlic Powder 1.1 1.1 1.1 1.1 Onion Powder 1.1 1.1 1.1 1.1 Lecithin 0.6 0.6 0.52 0.55 Turkey Meal 2.8 2.8 2.7 2.75 Chicken Meal 2.8 2.8 2.7 2.75 CaCO.sub.3 0.6 0.6 0.52 0.55 Tricalcium phosphate 0.6 0.6 0.52 0.55 VD 0.03 0.03 0.03 0.03 H.sub.2 O 8.47 8.47 8.01 8.23 Glycerol 16.9 16.9 16.0 16.5 Mechanical Properties Specimen Moisture Content(wt. %) 10.0 12.0 11.1 11.0 Tensile Strength (MPa) 1.53 1.99 2.23 1.76 Elongation (%) 65.2 27.4 40.3 63.8 Young's Modulus (MPa) 166 316 263 380 Processing Conditions T die (.degree. C.) 80 78 77 76 Screw speed (rpm) 150 150 150 150 Feeder rate (%) 24 31 30 22 Die pressure (psi) 170 180 210 260 .sup.1 Ingredients are same as in Table 1, and are based by total weight as 100 parts. .sup.2 Wheat Flour: GOLD METAL FLOUR .RTM., all-purpose, General Mills Sales, Inc. .sup.3 Sodium alginate: Alginic acid sodium salt, Research Chemicals Ltd. .sup.4 Nutricol GP 751 F: NUTRICOL .RTM. Konjac Flour blend with carrageenan and dextrose, FMC Corporation Marine Colloids Division

Detailed Description Paragraph Table (3):
TABLE 3 Sample No. Ingredients.sup.1 1 2 3 Soy Protein Concentrate (VF) 15.55 Wheat Gluten 15.55 Gelatin 8.5 Same Same Corn Starch 25.4 Garlic Powder 1.1 Onion Powder 1.1 Lecithin 0.6 Turkey Meal 2.8 Chicken Meal 2.8 CaCO.sub.3 0.6 Tricalcium Phosphate 0.6 VD.sub.3 0.03 H.sub.2 O 8.47 Glycerol 16.9 Mechanical Properties Specimen Moisture Content 10.0 9.0 6.1 (wt. %) Tensile strength (MPa) 1.53 4.08 476 Elongation (%) 65.2 16.1 5.38 Young's Modulus (MPa) 166 1451. 2610 Processing Conditions Same processing conditions: T die = Screw Speed Die pressure = 80(.degree. C.) 150 (rpm) 600 (psi) .sup.1 Ingredients are same as in Table 1, and are based by total weight as 100 parts.

Detailed Description Paragraph Table (4):
TABLE 4 Sample No. Ingredients.sup.1 1 2 Soy protein concentrate (VF) 100 100 Wheat Gluten 100 100 Gelatin 54.5 54.5 Corn Starch 163.6 163.6 Dietary fiber.sup.2 -- 72.7 Garlic Powder 7.3 7.3 Onion Powder 7.3 7.3 Lecithin 3.6 3.6 Turkey Powder 18.2 18.2 Chicken Powder 18.2 18.2 CaCO.sub.3 3.6 3.6 Tricalcium phosphate 3.6 3.6 VD.sub.3 0.2 0.2 H.sub.2 O 54.5 54.5 Glycerol 109 109 Mechanical Properties Specimen Moisture Content (wt. %) 10.0 10.0 Tensile strength (MPa) 1.53 2.34 Elongation (%) 65.2 25.7

Young's Modulus (MPa) 166 325 Processing Conditions T die (.degree. C.) 80 80 Screw speed (rpm) 150 150 Die pressure (psi) 170 880 .sup.1 Ingredients are same as Table 1, and are by parts based on soy protein concentration as 100 parts. .sup.2 Dietary fibers: purified powdered cellulose, Grade BH 65 FCC, 50 microns, International Filler Corporation.

Other Reference Publication (2):
Brother et al., "Protein Plastics from Soybean Products," Industrial and Engineering Chemistry, pp. 1648-1651 (Dec. 1940).

Other Reference Publication (3):
Huang et al., "Protein Structures and Protein Fibers--A Review, "Polymer Engineering and Science, pp. 81-91 (Feb. 1974).

Other Reference Publication (4):
Schilling et al., Mechanical Properties of Biodegradable Soy-Protein Plastics, J. Mater. Res., vol. 10, No. 9, pp. 2197-2202 (Sep. 1995).

Other Reference Publication (5):
Spence et al., "Soil and Marine Biodegradation of Protein Starch Plastics," American Chemical Society, pp. 149-158 (Nov. 1995).

Other Reference Publication (9):
Wang et al. "Effects of Polyhydric Alcohols on the Mechanical Properties of Soy Protein Plastics," J.M.S.--Pure Appl. Chem, pp. 557-569 (1996).

CLAIMS:

1. A nutritious pet chew comprising: an edible thermoplastic comprising about 30 to 50 wt. % protein comprising a mixture of plant and animal derived protein, about 20 to 50 wt. % starch, about 10 to 20 wt. % water, about 1 to 10 wt. % edible fiber, about 0.5 to 3 wt. % metallic salt hydrate, and wherein the edible thermoplastic when molded has a density of about 1.2 to 1.5 g/cubic centimeters.

2. The nutritious pet chew of claim 1, wherein the plant derived protein is soybean protein.

3. The nutritious pet chew of claim 2, wherein the soybean protein is selected from soy protein concentrate, soy protein isolate, and a combination thereof.

4. The nutritious pet chew of claim 1, wherein the plant derived protein is selected from the group consisting of gluten, zein, hordein, avenin, kafirin, secalin, oryzenin, and a combination thereof.

5. The nutritious pet chew of claim 1, wherein the animal derived protein is selected from the group consisting of casein, albumin, collagen, gelatin, keratin, and a combination thereof.

9. The nutritious pet chew of claim 1, wherein the edible fiber is selected from the group consisting of soluble and insoluble dietary fiber, soluble and insoluble natural cellulose fiber, and a combination thereof.